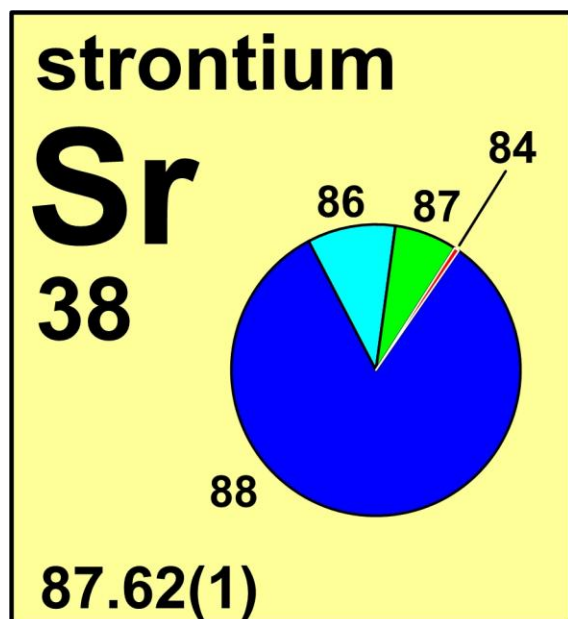
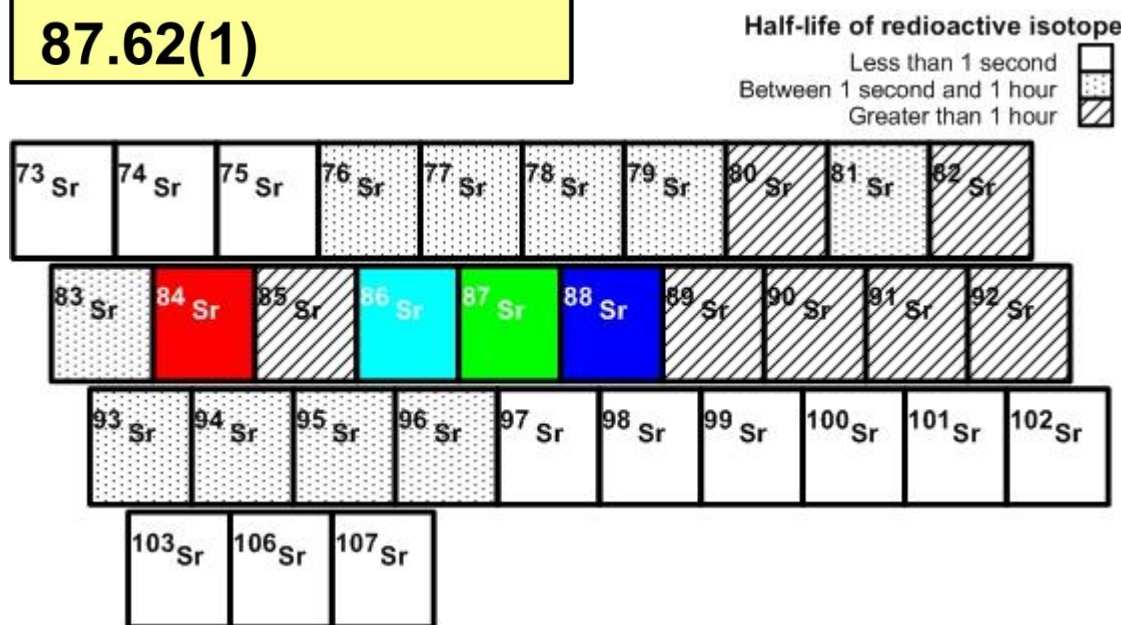


strontium



| Stable isotope | Atomic mass* | Mole fraction |
|------------------|--------------|---------------|
| ⁸⁴ Sr | 83.913 425 | 0.0056 |
| ⁸⁶ Sr | 85.909 2602 | 0.0986 |
| ⁸⁷ Sr | 86.908 8771 | 0.0700 |
| ⁸⁸ Sr | 87.905 6121 | 0.8258 |

* Atomic mass given in unified atomic mass units, u.



Important applications of stable and/or radioactive isotopes

Isotopes in geochronology and forensics

- 1) Most isotopic analyses of Sr have focused on the relative enrichment of the radiogenic isotope ⁸⁷Sr, which is a product of radioactive ⁸⁷Rb decay (half-life = 4.88×10^{10} yr).
- 2) The ⁸⁷Rb-⁸⁷Sr dating technique is one of the more useful tools for determining ages of rocks and minerals spanning the age of the Earth.
- 3) In addition, because the relative abundances of Rb and Sr are highly variable in natural systems, the ⁸⁷Sr/⁸⁶Sr ratio provides an excellent tracer of fluid-rock interactions, such as between magmas and host rocks, or groundwaters and aquifer solids.

- 4) Variations in the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of the ocean through time, as recorded in marine mineral deposits, can be related to the long-term geologic history of weathering and hydrothermal activity at the global scale (Figure 1).
- 5) Because highly variable $^{87}\text{Sr}/^{86}\text{Sr}$ ratios in rocks, minerals, soils, and waters can be transmitted to plants, animals, and manufactured materials, measurements of $^{87}\text{Sr}/^{86}\text{Sr}$ can be used for forensic applications in food authentication, archaeology, crime scene investigation, and human migration.

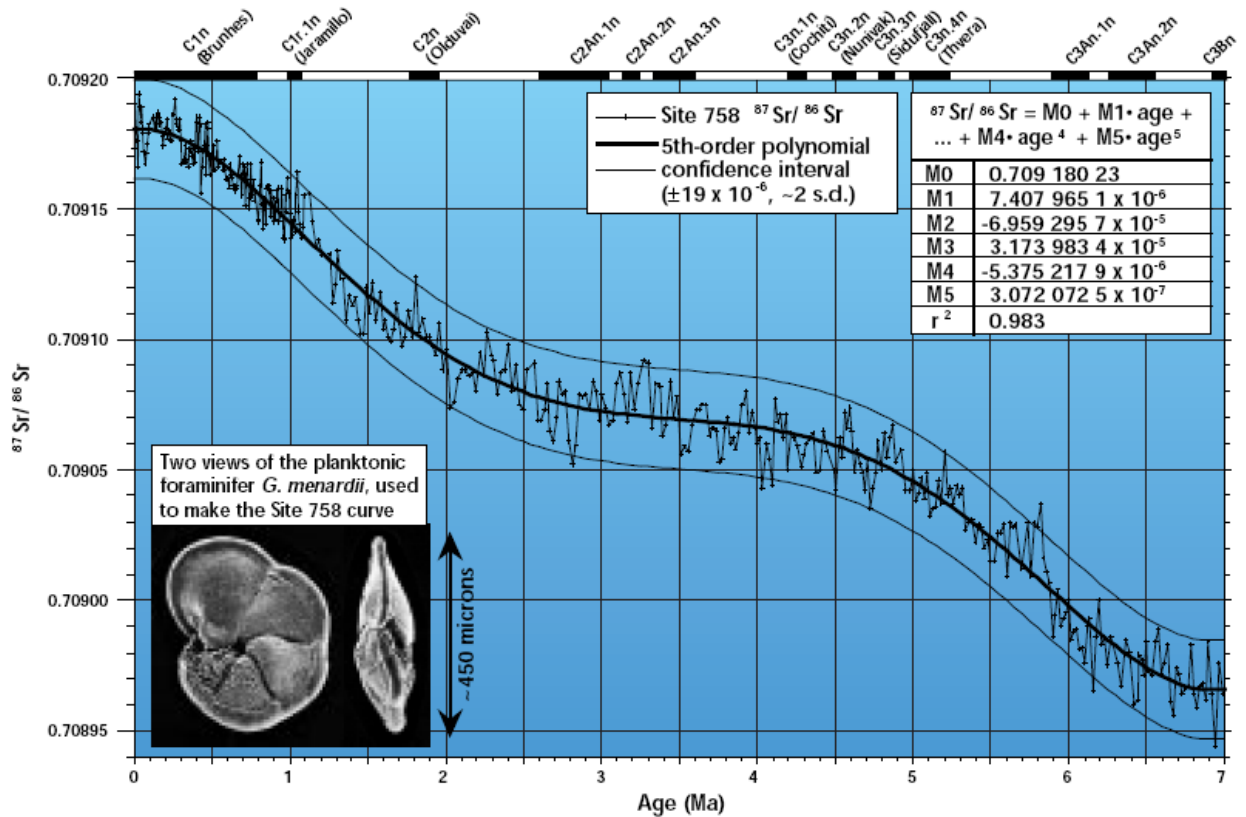


Figure 1: The relative abundance of natural radiogenic ^{87}Sr in seawater is related to the relative rates of seafloor spreading, mid-ocean-ridge hydrothermal activity, and continental weathering. Over geologic time, these processes have fluctuated such that the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio has changed systematically. By measuring this ratio in marine fossils of known age, it is possible to learn about when such changes occurred. Conversely, in some constrained situations, it is possible to estimate the ages of marine deposits (or at least permissible ages) by comparing measured ratios with the global time chart; this process is known as strontium isotope stratigraphy.

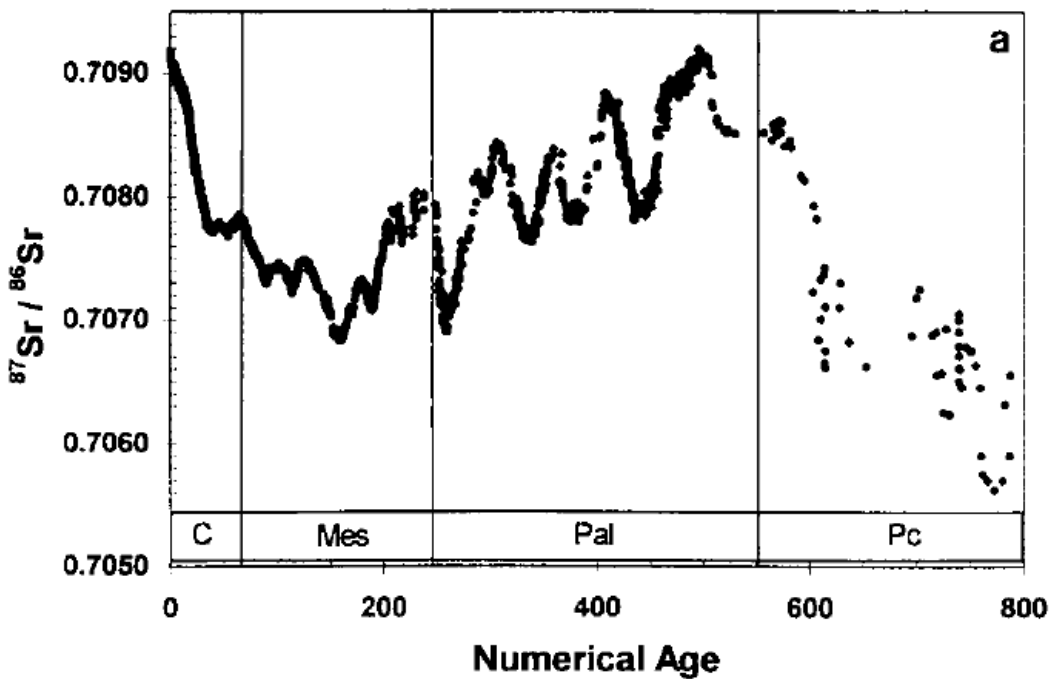


Figure 2: Trends in marine $^{87}\text{Sr}/^{86}\text{Sr}$ from 800 Ma to today. (McArthur and others, 2001)

Isotopes in fractionation and earth science

- 1) Stable isotope fractionation of Sr is small because the relative differences between the masses of stable Sr isotopes are small, and Sr is not subject to oxidation-reduction reactions in normal terrestrial environments. Nevertheless, recent studies have begun to explore potential applications of stable Sr isotope fractionation, for example as proxy for temperature during coral growth and for paleodietary information.

Isotopes in medicine

- 1) ^{89}Sr is a short-lived artificial radioisotope (half-life = 50.6 d) that is used for treatment of distributed bone cancer. Because Sr substitutes for Ca, ^{89}Sr administered in saline solution (e.g., intravenously) is preferentially incorporated into bone, where it decays, emitting beta particles that interfere locally with cell growth.